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ABSTRACT

A course was developed for teaching reading comprehension of English technical texts to German speaking professionals. Before proceeding with the course, students are administered a memory test and vocabulary test to determine their initial skill levels in English. The materials used for the course include learner's dictionaries of approximately 2,900 to 4,900 items for various technical areas. These dictionaries are compiled from English language specifications, descriptions, and other texts pertaining to the technical field. Dictionaries have been compiled on public switching systems for hardware and software, private switching systems, and communications and office automation. The 2-month course is divided into three stages: (1) intensive vocabulary learning; (2) classroom introduction to the reading of the technical texts on which the dictionaries are based; and (3) the tutorial stage, which involves discussion of problems that students encounter in reading texts of their own choosing. The teaching methods used in each stage are described. (Author/RW)

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A program for teaching and learning to read professional texts in a second/foreign language at Siemens AG.

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1. Introduction

This course was introduced at Siemens some three years ago. It was necessitated by the steadily increasing complexity and volume of international cooperation in the development of large-scale communications systems coupled with a growing demand on the part of many electrical engineers for a training in a reading understanding of technical texts.

The course was originally intended for engineers working in the research and development of modern switching systems. In the meantime, courses have been provided for people in other areas who have also been confronted with the necessity of having to be able to read professional texts in English fluently.

From the start it was evident that existing conventional courses were not adequate to cope with the demands and problems posed by this course. As a rule, such courses are geared to furthering expression in everyday life, normally using a situational vocabulary and based on what is taken to be the appropriate grammar.

The goal of the course is to achieve that fluent non-analytical comprehension of professional texts in English using the psychology of the Dual Processes (1).

Conceding the priority of context and that of vocabulary postulated in this psychology, ways had to be found to present this vocabulary. Mention should also be made of some other problems involved. These are e.g.

- to establish the extent of the previous second language experience of participants
- to establish their memorizing capabilities
- to develop ways and means of guiding and controlling participants in their learning

- to develop ways and means of adequately dealing with the grammar necessary for the specific goals of the course
- to find a course form which, in the environment of an industrial concern, would make our aims feasible within an acceptable time-scale.

Fortunately it was possible to have recourse to a system originally developed by Mr. Alford at the University of Essex and then at Cambridge, where solutions to a number of these problems have already been found.

2. Introductory Test

To proceed systematically, let me deal first with the introductory test used to establish memory ability and previous second language experience.

Memorizing abilities are measured before the course begins to obtain an objective evaluation of each individual's capability. This is necessary as, on the one hand, many participants tend to overestimate their prowess in this respect, especially if for some time they have not been used to regular learning using learning stretegies. On the other hand, the amount of vocabulary to be learnt during the course is considerable and demands sustained effort over a period of time.
The results of the test are a valuable indication both to the teacher and the participant of what can reasonably be expected.

2.1. Memory test

The memory test itself is made up of twenty word pairs, the stimulus word being a nonsense word which we defined to be from a little-known South-Indian dialect. The equivalents are in German. The method of learning is prescribed.
The amount of time for this exercise is measured and plays a role during the course.
Should an examinee need more than sixty minutes to learn these twenty words he is advised to stop and to get on with filling out the answer sheet.
This contains the same twenty stimulus words but in a completely different sequence and is to be filled out immediately after learning.

2.1.1 Time Results

Fig. 1 shows the memorizing times for 334 participants.

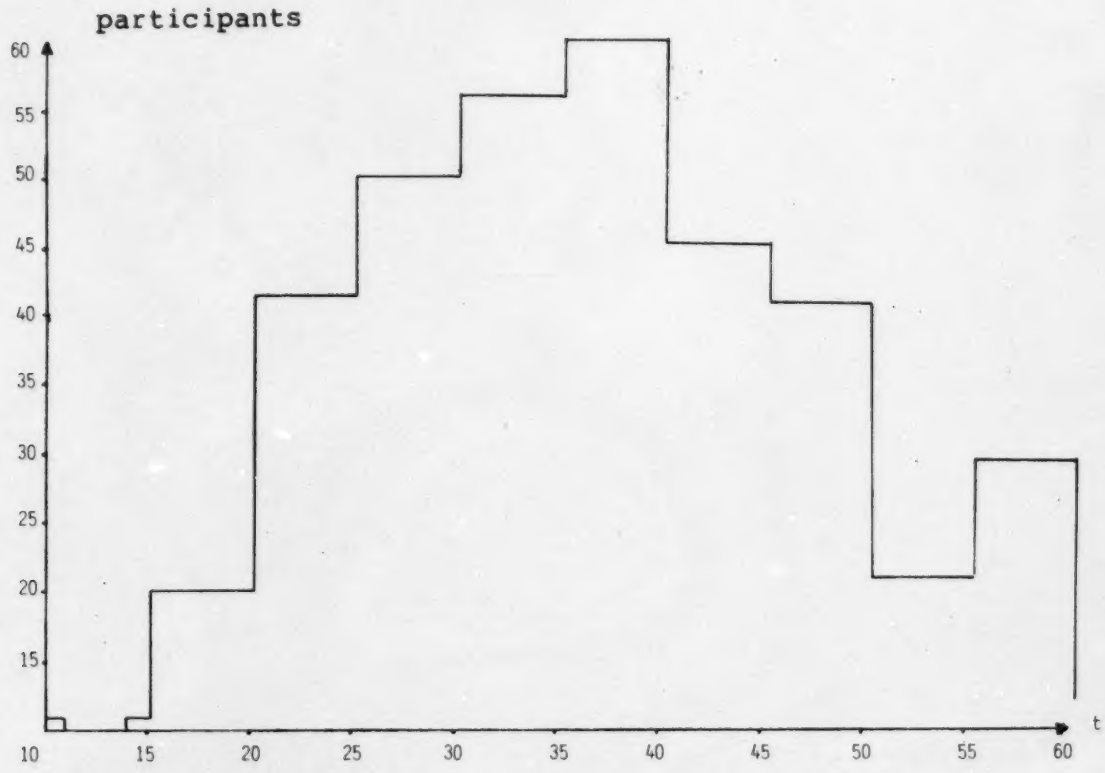

Fig. 1 Memorizing time

Of these, one managed the test in eleven minutes, another in fourteen. The person whe needed eleven minutes had two errors in his answer sheet. This achievment was so unusual that a few weeks later I asked him to fill out the answer sheet again.
He unhesitatingly agreed to do so. This time he had four errors, the two from the first test being repeated.
The participant who needed fourteen minutes had so many errors in the answer sheet that it was obvious that no serious attempt had been made to memorize the vocabulary.
Fortunately, such cases are few and far between.

Although one third of the participants can be classified as slow learners, one cannot consider them to be poor learners in the same way as fast learning is not necessarily synonymous with good learning. Some are simply not endowed with good memories, others are more deliberate in their learning and want to make sure that they have learnt everything. Then there are those who invest a considerable amount of time and energy in learning one, two or three words which seem to be more difficult to memorize than others.

2.1.2 Retention Results

The retention results are shown in Fig. 2.
They indicate that everyone has a more reliable memory than normally envisaged and that one need not mistrust the memory to the extent one generally does.

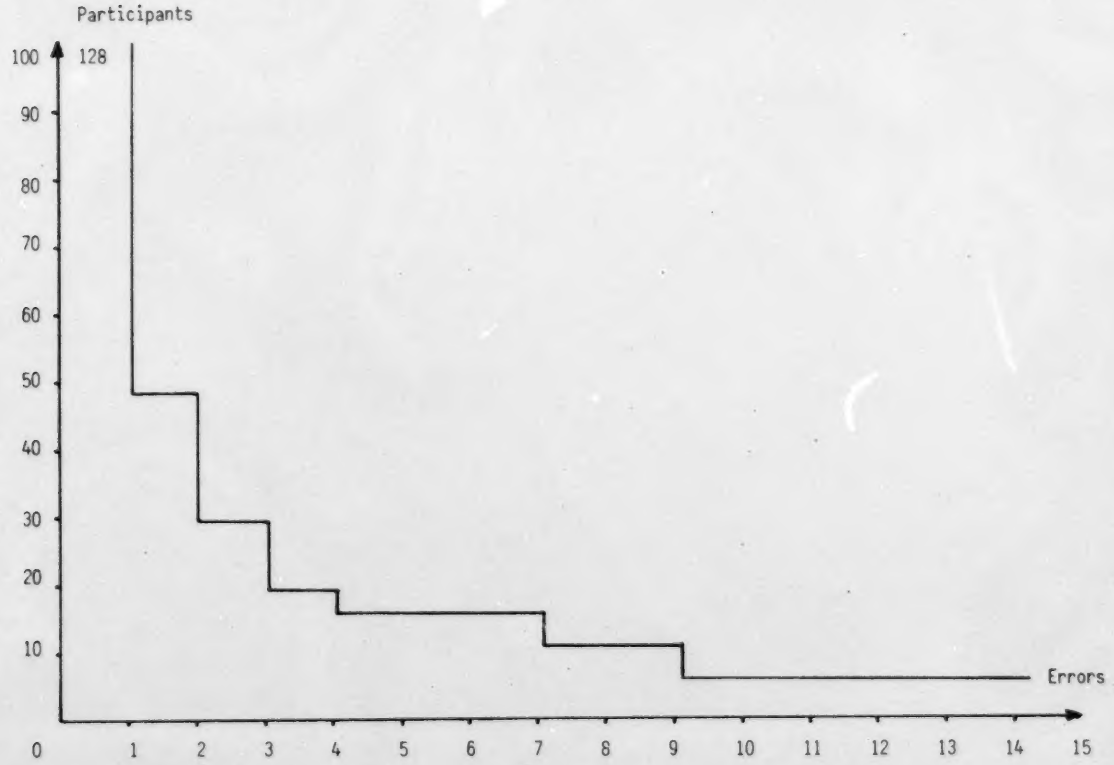

Fig. 2 Retention results

2.2. Vocabulary Test

The second part of the introductory test is intended to establish the extent of previous second language experience. The results are used to form homogeneous groups.

The test itself comprises forty English words with multiple choice answers.
All forty words are taken from the type of technical text, description or specification the participant will be required to deal with and belong to the category of high frequency words in these texts.
Of these forty words, the first group of twenty is also to be found among the English vocabulary most frequently taught in German schools. In other words, if the participants had English at school they ought to recognize the majority of them.
The second group of twenty words includes words which are to be found in a study of the Soviet Academy of Sciences dealing with high frequency, formal explanatory words as used in English scientific papers. If our participants have been doing any reading of a non-fictional, professional nature since their schooldays they ought to recognize some, if not all, of the vocabulary from the second group.

We recommend our participants not spending too much time brooding over the answers. Either they know them or they don't.

2.2.1 Results, Vocabulary Test

Fig. 3 shows the results of the vocabulary test. It indicates that in fact quite a number have learned English at some earlier stage but, if one follows the dotted line, they have not been engaged in reading of professional texts to any extent. Far more mistakes were made in Part Two of the test.

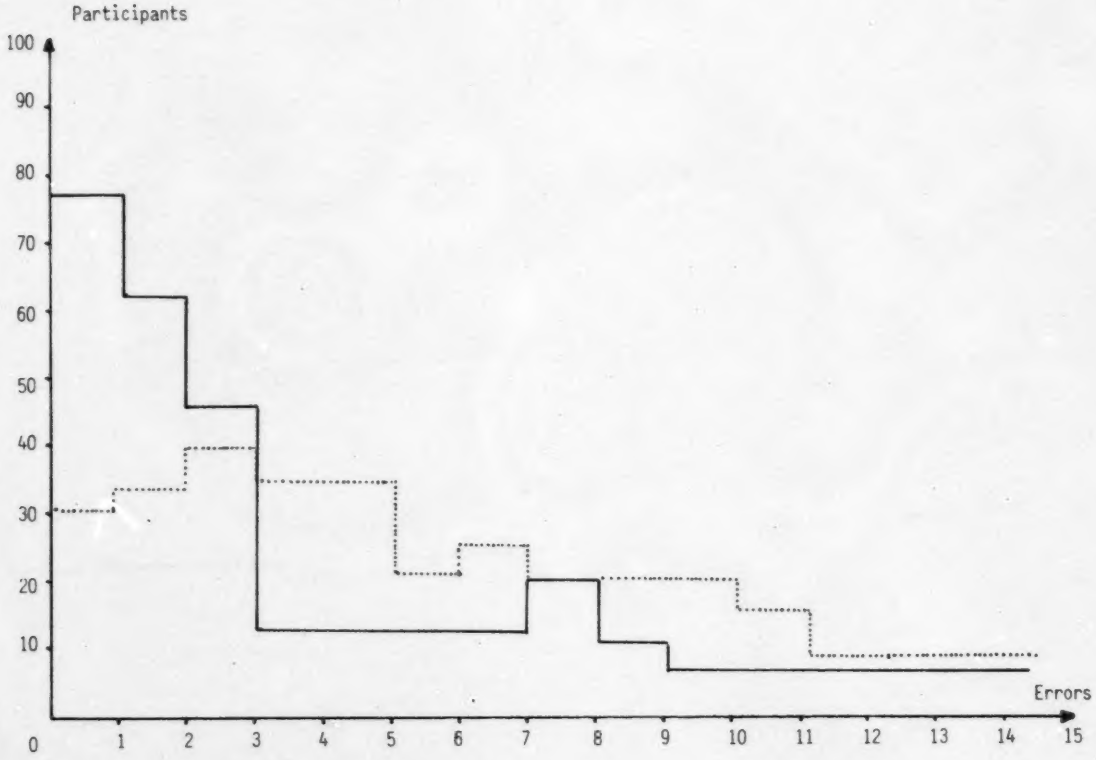

Fig. 3 Results, vocabulary test, part 1 + 2

3. Production of Materials

The primary material needed for these courses is a listing of the vocabulary for the specific professional area. It cannot be left to the learner to compile his own initial vocabulary. In these courses this listing takes the form of a

Learner's Dictionary (LD).

To date LDs have been produced for the following areas:

- Public Switching Systems, Hardware and Software
- Private Switching Systems
- Communications and Office Automation.

These dictionaries are not very large. The contain between 2.900 and 4.900 entries, depending on the technical area.

The English vocabulary for these dictionaries has been taken from texts from these fields. The texts are generally in a machine readable form and are chosen with those responsible for the technical area for which the dictionary is being compiled. Experience has shown that ten single texts with a total of up to 40.000 words is sufficient. The texts should be representative of the technical area and not contain large numbers of tables, diagrams or enumerations of technical features. Texts of the latter nature may be interesting for the technical process, from the point of view of reading understanding they are not to be recommended.

The selected texts are subjected to a statistical evaluation. The exact number of words in the texts, the frequency with which each word occurs and the cumulative text coverage are counted.

There are two print-outs made of the dictionary. One is sorted alphabetically and is used more as a reference work.
The LD is printed in descending order of frequency. This means that participants learn the most frequently occuring words first. It is the best way of learning vocabulary. Known fields of reference of lexical meaning are easily extended and immediately effective. In conjunction with texts it means that unknown words appear less and less frequently and that their meanings can more easily be derived from context.

After the statistical evaluation of the texts the necessary equivalents, in this case the German meanings, still have to be included. With regard to the sequence of the equivalents for each entry it was decided to first enter the normal, common meaning of the word and then the technical. For the common meanings we relied on standard works. The technical meanings were either taken from existing terminology pools or were provided by our own translators or terminologists.

Basically each entry in the LD contains all the necessary information for the technical area. This quantity of information is the amount to be learnt when one meets the word for the first time. The entry does not include all the common meanings for a word. This would defeat the purpose of an LD.

4. The Course

The course is divided into the following phases:
- intensive vocabulary learning (8 - 10 days)
- daily classes, using parallel teaching texts (3 weeks)
- tutorials (3 - 4 weeks).

The course begins with introductory lectures on human memory and on methods and other aspects of learning.

4.1. Intensive vocabulary learning

Participants are expected to learn vocabulary right from the very first day of the course. The amount of vocabulary depends on the results of the memory test. Fig. 4 shows the relationship between these results and the daily learning pensum.
Memory times of "up to 30 minutes" are considered to be very good, "30 - 40 minutes" is good and above that is poor.
Accordingly, we expect the first group to learn 30+ words daily, group 2 to learn 30 and group 3 to learn up to 30 words. For some this means up to 100 equivalents.
Originally it was estimated that 45 minutes of learning time after having written down the words would be sufficient.

Memorizing Times	Learning Pensum
20 - 30 minutes: very good	30+ words
30 - 40 minutes: good	30 words
40 - 60 minutes: poor	up to 30 words
	5 days a week
	45 minutes daily

Fig. 4

In reality, participants need far more time. I will explain shortly how this is controlled.

I want to stress that participants generally do not have time during their working hours to learn vocabulary. Their free time, mornings or evenings, is reserved for this.

4.1.1 Learning Method

Learning of vocabulary by repeated reading of lists is to be avoided. For this reason we recommend using cards which can be shuffled.
On the one side the English word is written down, alone and in capitals. We recommend capitals because we have found that many have difficulties reading their own handwriting.
On the rear side of the card the meaning(s) of the word are written down along with any mnemotechnical aids the participant may devise for himself.
If nothing else we strongly advise noting the initial letter of a German word als learners frequently need only an indication of the beginning of a word they cannot remember to bring this above the threshold of recall.
The general procedure when learning is to cover the German column in the LD and to work down the English column, ticking off the unknown words until the daily pensum has been reached. These words are then transferred to cards and learnt.
It is important that participants are not left to their own devices at this stage of the course. During this phase we have classes every third day. These are used primarily to see whether the data sheets are being used correctly or not. I also use the opportunity for a brief survey of grammar and, depending on how good the group is, give a short introduction to the origins and development of the English language.

4.1.2. Data Sheets

The data sheet is an invaluable instrument enabling the teacher to observe, advise and control each participant as to his progress and learning. It also provides the interested participant with insights into the working of his own memory and learning.

It has two parts, a task sheet and a control sheet.

4.1.2.1 The Task Sheet

The task sheet shows what is to be done daily and in what sequence.
On the first day there is merely the first pack of cards to be written out and learnt.
On the second day the first task is to check on the previous day's work and see how many words have been forgotten before going on to learning the next pack. This rhythmus is continued for a week, when once again the daily work begins with a check of what had been learnt a week previously, then the day previously before proceeding to the next pack.

When I speak here of checking the previous day's work, etc. I mean that the participant goes through a pack of cards quickly without looking at the German equivalents. He simply asks himself whether he still knows these meanings. He notes the number of words forgotten since the initial learning. Relearning does not take place at this stage.

At the beginning of the third week of vocabulary learning there is a slight difference in procedure. Forgotten words in a pack learnt a fortnight earlier are now extracted from the original pack and are inserted into a refresher pack which is worked on only when a sufficient number of words has accumulated. These are then relearnt.
Here the effects of saving on relearning become immediately obvious.

The number of words in a refresher pack varies from participant to participant and would apparently depend to a large extent on the individual's self-confidence in being able to relearn and now retain a larger or smaller number of words. This number varies between 30 and 50.

4.1.2.2 The Control Sheet

The control sheet is used to keep track of details about each individual pack of cards. The participant notes here how many words there are in each pack and how many words he has forgotten after check 1, 2 and 3. He also notes how much time it took to compile a pack and how much formal and informal time he has spent learning them.

Informal learning times can best be described as those odd moments during the day, e.g. waiting for a bus or a train, queuing in a restaurant, waiting for an appointment, commuting times etc., which can be used for a quick look through the pack of cards. One finds that there are several such moments during the day which can be used for this purpose and to good avail. The advantage of such informal learning sessions is a growing acquaintance with the vocabulary. This becomes easier to learn.

Formal learning time is the time devoted consciously, purposefully and solely to memorizing the words in a pack. There can be several such formal learning sessions daily, depending on the memorizing capabilities of the individual.

One of the most important duties of the teacher, at least during the early stages of the course, is to keep a careful eye on the times spent on learning. Exessive times are often an indication of misguided attempts to learn a couple of words which are difficult for the individual to recall. Others, again, must find their best time of day for learning. Naturally, this varies, from early morning till late at night.
The optimum is achieved when learning times are in relation

to the number of words in a pack and to the number of words retained after learning. The quality of the learning becomes evident during classes with the parallel teaching texts.

This first phase of the course gives the participants the opportunity they need to acquire a large portion of the most frequently occurring words that must be known before reading commences. Poor learning during this phase is hard to make up for during the following phases.

4.2. Learning to read, using parallel texts

The second phase of the course is devoted to a guided approach to reading professional texts. It generally lasts three weeks with class taking place daily, each class lasting 45 minutes.

Text Material

The texts used here are a subset of those used to compile the LD. This means that participants begin this phase knowing much of the high-frequency vocabulary they encounter in their very first text. In addition, each person in given a copy of the original German text. We do this because trying to read a foreign text while still knowing too small a vocabulary and also being as yet unfamiliar with the grammar is very inefficient and would invariably lead to a mere translation exercise.

The sub-conscious drive to translate is one that is very difficult to suppress and if not suppressed can have detrimental effects. This problem is treated in the following way:
Participants are asked to read e.g. one page or a section of text in the native language. The quantity to be read must exceed the quantity to be read in the second/foreign language.

The facts are to be extracted from the native text. Reading

more in the native language than is required to be read in the English text means that the native grammar cannot be recalled but the contents can. In this way, extensive remembering is established. Participants then read through the text in the second language relating their knowledge of the facts to the vocabulary in this text. The fact that the texts chosen for this purpose generally have to do with some facet of their own work is an additional aid. This enables them to fall back on large fields of experience with an abundance of supplementary information which makes initial reading of documents in a second language easier.

It is of great importance that the participants experience success from the very first day on. This success may only be in the form of recognizing vocabulary learnt during the previous week but they see that they can already partially understand this text and that is a tremendous incentive to keep going.

Participants are heavily inundated with work at this stage of the course.
They have vocabulary to learn, they have class to attend, texts to cope with which harbour more problems than just simple vocabulary and they have further material they are asked to study and prepare.

4.2.1 Vocabulary

They continue learning vocabulary from the LD. They continue their daily check routine.
After check 1, in other words on the next day, they have generally retained most of all they have learnt. A week later, after check 2, the number of forgotten words tends to increase. These sometimes constitute 30 - 40 % of the original pack.
What is the situation after check 3?
Fortunately, the number of forgotten words falls here due to the daily contact with the texts and their increasing

prowess in reading.
Interestingly enough, the forgotten words after check 3 do not always coincide with those forgotten earlier. This depends on whether these words have occurred in the reading texts or not.

During this stage of the course participants are advised to reduce the amount of vocabulary they are learning. This advice is always on an individual basis as the progress of each participant through the LD is quite different. The teacher can easily judge when this point has arrived on the basis of the entries in the data sheet.
The time gained by learning less vocabulary is to be used for further reading.
This is the best method of recognizing and expanding vocabulary.
Another reason for promoting further reading is that in the heel of the hunt the participants must be weaned from texts in the native language and, depending on their capabilities, encouraged to rely on texts in the second/ foreign language for their understanding.

4.2.2 Grammar

One of these capabilities has been built up constantly from the beginning of the course, the vocabulary. Another capability involves the rules and structures of the language, the grammar. Originally we set about teaching grammar in the traditional way. This proved to be most unsatisfactory as it impeded understanding and because the parallel teaching texts abound in apparent irregularities and do not conform to the structure of traditional, conventional grammars. These also impart information at the wrong frquency.

It was then decided to do an exact analysis of the grammar occurring in a large number of technical and narrative texts by different authors on different topics. Briefly, descriptive technical texts make predominant use of the passive, restrict tenses to the present and the past with

occasional excursions into the future or the present perfect. They seldom make use of the modals and, in relation to the volume of text, scarcely any use of pronouns. Negatives are few and far between. Basically the same applies to the narrative texts, the major difference being the more frequent use of the active and of the modals.

Adhering to the principle of frequency applied in learning vocabulary, these grammatical occurrences were weighted and the ensuing sequence used to demonstrate grammar which had already been explained in theory.
To this end concordances are made, using the vocabulary in the LD. The amount of context is generally sufficient to allow an understanding. The advantage of such a KWIC-concordance is that the participant sees a particular word or phrase, a syntactic feature, which for this purpose becomes an invariable, a constant, in an ever-changing, variable context and thus is made aware of the multitude of possible usages of this particular word or phrase.

Another advantage of the concordances is flexibility as literally any aspect of grammar in a given body of text can be examined at length and in detail at wish.

We have found the use of concordances for teaching grammar has brought results exceeding by far any method known to the author.

Concordances are, however, not a substitute for formal grammars. They are simply an enormously successful way of expanding on grammar in such a way that valid frequencies are brought home to the course participants with little or no effort.

4.3. Tutorials

The tutorials phase of the course lasts three to four weeks. For tutorials the class is subdivided into small units of two participants each. Tutorials take place every second day for each unit and last 30 minutes.
The participants are required to do extensive reading of texts of their own choice. They have to come well prepared to the tutorials as time is too limited to go through texts in detail with them there.
Participants come to discuss and not discover their problems with the texts.

4.3.1 New Vocabulary

Basically there are three types of problems. The major one has to do with vocabulary that is neither in the LD nor in other dictionaries.
This is frequently the case with topics which are very new and where terminologists and lexicographers have not yet had time to assimilate these terms. An educated guess often brings the correct answer.
One part of the strategy of reading which we attempt to teach participants during tutorials is how to react when they come across words they haven't met before and, in this connection how to use a dictionary correctly and intelligently.

4.3.2 Sentence Structures

Although a lot of time is spent during phase 2 of the course treating sentence structures, they remain an evergreen during tutorials as well. The normal complaint is that English sentences are so long and full of clauses and why doesn't English make more use of commas.
Here again it is a question of assiduously pointing out these structures to the participants and making them aware of them.

Heightened awareness alleviates the problem, continuous practice eliminates it.

4.3.3 Concatenation

Another problem is the concatenation of nouns to compound nomimal phrases to form one concept. This can be very confusing, especially for someone not particularly well acquainted with the material.
Phrases like "software system safeguard failure monitor function" may be intelligible for the inaugurated, for the novice they are mind-boggling.

5. Conclusions

The permanent confrontation with texts over a prolonged period of time leads to an interesting development in most participants.
Almost all start off, consciously or unconsciously, by translating English texts into their mother tongue. They pay more attention to the individual words and syntactic structures than to the actual meaning.

Due to greater familiarity with the vocabulary this focus of attention gradually changes.

There is a notable change from an understanding of the language to an understanding in the language.

A further transition is towards a thinking in the language. This expresses itself quite simply e.g. in the fact that the inclination to translate continually decreases, in the fact that sentence structures are no longer the insurmountable hindrance they once were, that, instead, a reading understanding improves to such an extent that towards the end of the tutorials participants say there is nothing more can be done to improve their reading understanding.

(1) Alford, M.H.T. 1982. Transfer of Lexical Meaning and The Learning of Valid Frequency Grammar.
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